

WHAT IS CLAIMED IS:

SubB1> 1. A rotary drill bit for penetrating earth strata, the drill bit comprising: an elongate bit body having an axial forward end; and a monolithic hard insert being affixed to the bit body at the axial forward end thereof, and the hard insert presenting at least three discrete leading cutting edges for cutting the earth strata wherein each said at least three cutting edges is stepped whereby the step improves the disintegration of the earth strata.

2. The rotary drill bit of claim 1 wherein the stepped cutting edge has an upper step and a lower step.

3. The rotary drill bit of claim 2 wherein the leading cutting edge of the upper step and the leading cutting edge of the lower step are parallel.

4. The rotary drill bit of claim 1 wherein both said leading cutting edges of the lower step and upper step are oriented at an angle of about 20 degrees with respect to the horizontal.

SubA1> 5. The rotary drill bit of claim 2 wherein a transition portion is positioned between the lower step cutting edge and the upper step cutting edge the transition portion rises a vertical height of generally between 1/16-1/8.

SubB1> 6. The rotary drill bit of claim 1 wherein the rotary drill bit having a central longitudinal axis passing through the hard insert, the bit body having a peripheral surface, and each one of the leading cutting edges for cutting the earth strata begins at a point radially outward of the central axis of the hard insert and extends in a direction away from the central axis.

7. The rotary drill bit of claim 1 wherein each one of the leading cutting edges for cutting the

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~~earth strata being formed by a corresponding leading surface of the hard insert intersecting a corresponding top surface of the hard insert.~~

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8. ~~The rotary drill bit of claim 6 wherein each of the stepped cutting edges has an radially inward upper step and a lower step.~~

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9. ~~The rotary drill bit of claim 8 wherein said cutting edge of each said upper step and lower step has a length of generally between 1/8-1/4 inches.~~

10 10. The rotary drill bit of claim 1 wherein each one of said leading cutting edges has a leading surface being disposed at a rake angle of between about zero degrees and about negative fifteen degrees.

15 11. The rotary drill bit of claim 2 wherein each one of said cutting edges has a lower leading surface adjacent the lower step cutting edge being disposed at a rake angle of between about zero degrees and about negative fifteen degrees.

20 12. The rotary drill bit of claim 11 wherein each one of said upper steps has an upper leading surface adjacent the upper step cutting edge the upper step cutting edge being disposed at a rake angle of between about zero degrees and about fifteen degrees.

25 13. The rotary drill bit of claim 2 wherein the upper step cutting edge has a relief angle of about 30 degrees and the lower step has a relief angle of about 21 degrees.

30 14. The rotary drill bit of claim 2 wherein the lower step has a generally planar lower rake surface and the upper step has a second generally planar upper rake surface.

15. The rotary drill bit of claim 14 wherein the lower rake surface forms an angle with the vertical

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~~different from an angle which said upper rake surface makes with the vertical.~~

16. The rotary drill bit of claim 15 wherein the lower rake surface angle is between zero and negative ten degrees and the upper rake surface angle is zero and fifteen degrees.

17. The rotary drill bit of claim 16 wherein said lower rake angle is zero degrees and the upper ~~rake angle is negative five degrees.~~

18. The rotary drill bit of claim 1 wherein the drill bit body having at least one scalloped portion containing a debris port therein, and a debris breaker being in the scalloped portion mediate of the debris port and the axial forward end of the drill bit body.

19. A rotary drill bit for penetrating earth strata, the drill bit comprising: an elongate bit body having an axial forward end; and a hard insert being affixed to the bit body at the axial forward end thereof, and the hard insert having at least three discrete leading cutting edges for cutting the earth strata wherein each said at least three leading cutting edges are nonlinear.

20. The rotary drill bit of claim 19 wherein the hard insert has a generally planar lower rake surface and the upper step has a second generally planar upper rake surface.

21. The rotary drill bit of claim 20 wherein the lower rake surface forms an angle with the vertical different from an angle which said upper rake surface is offset from the vertical.

22. The rotary drill bit of claim 19 wherein the hard insert being a single monolithic member.

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23. A hard member for attachment to a drill bit body so as to form a rotary drill bit for penetrating the earth strata and the rotary drill bit having a central longitudinal axis, the hard member comprising: at least three discrete leading cutting edges for cutting the earth strata projecting from the forward surface of the hard member wherein each said at least three cutting edges is stepped whereby the step improves the disintegration of the earth strata.

10 24. The hard member of claim 23 being a single monolithic piece.

SbA5> 25. The hard member of claim 24 wherein the hard insert further including a side clearance cutting edge for cutting the earth strata corresponding to each 15 one of the leading cutting edges for cutting the earth strata.

26. The rotary drill bit of claim 24 wherein the stepped cutting edge has an upper step and a lower step.

20 *SjPA1* 27. The rotary drill bit of claim 26 wherein the cutting edge of the upper step and the cutting edge of the lower step are parallel.

25 28. The rotary drill bit of claim 23 wherein the rotary drill bit having a central longitudinal axis passing through the hard insert, the bit body having a peripheral surface, and each one of the leading cutting edges for cutting the earth strata begins at a point radially outward of the central axis of the hard insert and extends in a direction away from the central axis.

30 29. The rotary drill bit of claim 26 wherein each one of said upper steps has an upper leading surface adjacent the upper step cutting edge the upper step cutting edge being disposed at a rake angle of between about zero degrees and about fifteen degrees.

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30. The rotary drill bit of claim 29 wherein
the lower step has a generally planar lower rake
surface and the upper step has a second generally
planar upper rake surface.

5 31. The rotary drill bit of claim 30 wherein
the lower rake surface forms an angle with the vertical
different from an angle which said upper rake surface
makes with the vertical.

10 *Sub A7* 32. A hard member for attachment to a drill
bit body so as to form a rotary drill bit for
penetrating the earth strata said hard member
comprising: at least three discrete leading cutting
edges for cutting the earth strata wherein each said at
least three leading cutting edges are nonlinear.

15 *Sub B4* 33. The hard member according to claim 32
wherein the leading cutting edge has an upper step and
a lower step.

20 34. The hard member according to claim 33
wherein the lower step has a generally planar lower
rake surface and the upper step has a second generally
planar upper rake surface.

25 35. The rotary drill bit of claim 34 wherein
the lower rake surface forms an angle with the vertical
different from an angle which said upper rake surface
is offset from the vertical.

36. The rotary drill bit of claim 32 wherein
the hard insert being a single monolithic member.

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